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even by the mountains, colors that vie with sunsets, and sounds that span the diapason from tempest to tinkling raindrop, from cataract to bubbling fountain. But more, it is a vast district of country. Were it a valley plain it would make a State. It can be seen only in parts from hour to hour and from day to day and from week to week and from month to month. A year scarcely suffices to see it all. It has infinite variety, and no part is ever duplicated. Its colors, though many and complex, at any instant change with the ascending and declining sun; lights and shadows appear and vanish with the passing clouds, and the changing seasons mark their passage in changing colors. You cannot see the Grand Canyon in one view, as if it were a changeless spectacle from which a curtain might be lifted, but to see it you have to toil from month to month through its labyrinths. It is a region more difficult to traverse than the Alps or the Himalayas, but if strength and courage are sufficient for the task, by a year's toil a concept of sublimity can be obtained, never again to be equaled on the hither side of Paradise."

Considered as a whole, the book is a monograph on a region classic in geology and ethnology, and a summary history of the development of science in this region. It is at the same time a record, unique in its fullness, of a memorable exploratory trip, the most arduous, save that of Francisco Pizarro on the headwaters of the Amazon, in the annals of America, and one saved from the verdict of foolhardiness only by success. No geologic or ethnologic library or collection of Americana will be complete without it. As a historical treatise the work might have been made more valuable by setting forth the origin and development of great generalizations, and tracing the growth of knowledge concerning the region and its various aspects, though by such treatment its simplicity and unity would have been impaired.

From preface to summary the pages teem with matter-of-fact reason, mingled with poetic imagery, expressed in clear and fluent language. The strong personality of the author can be read only between the lines of scientific observation or generalization, or of the narrative of patient and persevering mastery of natural forces in the canyon. Reading between the lines, the philosophy of the author may be recognized in its practical application. He explored the canyon to the end that knowledge

might be gained; he trained collaborators in geology and ethnology, giving them freely of his acute observations and profound generalizations, to the end that knowledge might be diffused; he would have it that the book should be a monument to his companions in the exploration, including those who faltered at the eleventh hour; and self is lost in the immortality of knowledge useful to mankind.

The publishers have done their part well. The print is large and clear and carefully proof-read; the paper is good, and the illustrations are ample and well selected. Nearly all of the illustrations have been used before, either in governmental publications or in magazines, and to some readers this fact may convey a bad impression; but all of the illustrations have grown out of the work of the author. In some cases, too, it might have been desirable to connect the illustrations more closely with the text by legend or otherwise, and this was perhaps avoided only through desire to economize space. The cloth binding is good, and the binding in leather is excellent.

W J MCGEE.

*Petrology for Students.* An introduction to the study of Rocks under the Microscope. By ALFRED HARKER. Published by Macmillan & Co., New York. 1895. Price, \$2.00.

As the author states in the preface, this text-book is prepared especially for English students, nevertheless, it will be found very useful for those beginning the study of petrography in this country who wish a text-book written in English. No systematic account of the crystallographic and optical properties of minerals has been attempted, and for such information the student is referred to the translation of Professor Rosenbusch's volume on the rock-making minerals. But as an introduction to the study of the rocks themselves a number of useful observations of a general nature are presented upon the characters of minerals in this section, and especially the latest methods of distinguishing the different varieties of feldspar. In treating so complex a subject as the optical properties of minerals in thin sections in such a condensed manner it is doubtful whether the author can meet the wants of a beginner. It

serves, however, as a form of definition of the terms used throughout the book. It would seem that in neglecting the use of those methods of determination based on the optical phenomena observed with converging polarized light the author needlessly weakens the processes of petrographical diagnosis.

In his remarks upon the examination of rock sections the author shows his appreciation of the broad field of the science, which, as he says, is not merely an attempt to discover the composition of a rock, but to unravel its history as well. His clear understanding of the subject is also shown in his discussion of the classification of rocks, especially those of igneous origin. In the present chaotic condition of the nomenclature of rocks it will be difficult for any one who does not succeed in reforming the whole system to classify rocks to his own complete satisfaction or to the satisfaction of any one else. In his attempt at simplification Mr. Harker has shown his independence to a considerable extent, while following in the main the classification of igneous rocks adopted by Rosenbusch, though under a different terminology. Thus massive igneous rocks are subdivided into *plutonic*, *intrusive* and *volcanic*, corresponding to *tiefengesteine*, *ganggesteine* and *vulkanische gesteine*. In many other ways also the author follows the methods and principles of Rosenbusch. Under each of the three great divisions above named the rocks are arranged according to their mineralogical or chemical composition, beginning with the most acid. The names used for varieties of rocks within different families are generally those expressing the mineralogical characteristics of the particular variety rather than those of a geographical character which may already be in common use. But in most cases both names are given. The most noticeable instance of this is in the peridotites.

In substituting the term *intrusive* for that of *ganggesteine*, and in maintaining an independent grouping for certain varieties of intrusive rocks, the author has not improved on the presentation of the case as made by Rosenbusch; and his remarks in introduction of his *intrusive* division are in the nature of an apology.

Nor does his use of the term acid intrusives, in distinction to that of porphyries and por-

phyrites, appear to be fortunate. Diabases are classed as intrusives. Under *volcanic* rocks no distinction is made between older and younger lavas, which certainly seems to be the only proper method of treatment. In this respect the classification follows the English usage. Fragmental products of volcanic action are described in connection with sedimentary rocks.

The descriptions of the various rocks embrace a general definition in mineralogical and structural terms, followed by an account of the constituent minerals and of the microstructure. Illustrative examples are chosen as far as possible from occurrences in Great Britain. The many references to the writings of British geologists and numerous others to the works of foreigners add greatly to the usefulness of the book for more advanced students.

The sedimentary rocks are divided into *arenaceous*, *argillaceous*, *calcareous* and *pyroclastic* kinds. Under the first division the general terms are defined and the characters of the derived grains and of the authigenous constituents are discussed separately. In this way the general characteristics of all arenaceous rocks are given rather than the specific character of any one kind of rock. In the chapter on argillaceous rocks the general definitions are first given, then the characters of the constituent minerals, followed by that of the structure. The description of illustrative occurrences serves to supply the need of some definite picture of different kinds of these rocks. The treatment of calcareous rocks is admirable for so condensed a statement. It deals first with the source and composition of these rocks; then the structure of organic fragments, followed by oölitic structure; the character of the matrix and of deep-sea calcareous deposits. Finally metasomatic changes are described and British examples cited. References to the literature of the subject are numerous and valuable. Pyroclastic rocks are briefly treated. Deposits due to chemical or to organic agencies are described in a few short paragraphs.

Under the head of Metamorphism the author discusses the general principles of the subject, and then describes the changes produced by thermal metamorphism upon the different kinds of sedimentary rocks, and upon igneous rocks

and the crystalline schists. This is followed by an account of the effects of dynamic metamorphism upon the minerals and structures of rocks. Very little space is devoted to the petrographical description of the various kinds of crystalline schists, which are grouped under the heads of *crystalline schists*, *gneisses*, *granulites* and *eclogites*. The basis of classification is structure. The book shows careful preparation, and although the reviewer has taken exception to some features of it he would recommend it to all those beginning the study of petrology.

JOSEPH P. IDDINGS.

#### SCIENTIFIC JOURNALS.

THE AMERICAN JOURNAL OF SCIENCE,  
NOVEMBER.

THE November number of the *American Journal of Science* opens with an article by A. De Forest Palmer, Jr., of Brown University, giving the results of measurements made at Baltimore in 1893 upon the  $D_3$  helium line in the solar spectrum. The observations were made with a large telescope spectrometer with a plane speculum metal grating, the line in question being compared with the best standard lines in the field of view. Seventeen series of measurements were made, an equal number of observations being made on opposite points of the sun's limb to eliminate the effect of rotation. The average of the seventeen values obtained was  $5875.939 \pm .006$ . A paper by E. A. Hill discusses the new elements argon and helium with special reference to the question as to the atomicity of argon. It is argued that the observations thus far made are not conclusive as proving that it is monatomic; some suggestions are also made as to the relations between the elements named and other elements as shown in the periodic classification of Mendeléeff. Professor W. LeConte Stevens gives the remainder of his address delivered before Section B of the American Association upon 'Recent Progress in Optics;' the earlier part was published in the October number. Wells and Hurlburt describe a series of ammonium-cuprous double halogen salts. Other chemical articles are by Gooch and Evans upon the reduction of selenic acid by hydrochloric acid, and by Gooch and Scoville upon its reduction

by potassium bromide in acid solution. L. V. Pirsson describes some phonolitic rocks from the neighborhood of the Bear Paw Mountain in Montana; one of these contained large crystals of pseudo-leucite, resembling those of Brazil and Magnet Cove, Arkansas. S. L. Penfield and J. H. Pratt give the results of an investigation of a series of minerals of the triphylite-lithiophilite group  $(Fe, Mn)LiPO_4$ , which show that the replacement of iron by manganese has a remarkable influence upon the optical properties. Two articles are given by O. C. Marsh, the first upon the Reptilia of Baptonodon Beds of the Rocky Mountain Jurassic; the second upon the restoration of some European Dinosaurs. Four plates accompany the latter paper, giving restoration of the genera: *Compsognathus*, *Scelidosaurus*, *Hypsilophodon*, *Iguanodon*. This paper was read before Section C of the British Association at the Ipswich meeting in September last. The concluding twenty pages of the number are devoted to abstracts, book notices, etc., in various departments of science.

AMERICAN CHEMICAL JOURNAL, OCTOBER.

THIS number of the Journal contains contributions from several laboratories and reviews of new books on chemistry. Two papers by White and Jones on the Sulphonphthaleins contain results of work carried on in the laboratory of the Johns Hopkins University on this class of compounds. Four articles containing results of work in this line have already appeared. White prepared bromine and chlorine products of sulphonfluorescein, but found that the sulphonfluorescein itself could not be prepared by the action of resorcinol on orthosulphobenzoic acid, the product in this case containing four or six residues of resorcinol instead of two. Jones obtained similar results using the paramethylsulphonphthalein. Jackson and Grindley contribute the first of a series of papers upon the action of sodic alcoholates on chloranil. A number of substances were made belonging to a class which had not been very thoroughly investigated before and to which the authors give the name hemiacetals. The discovery of the hemiacetals of the quinones has led them to suggest a possible explanation of the constitution of quinhedrone and